# Build A Light Pen

## By Scott Fluhrer

There are many interesting peripherals you can connect to your computer, including analog inputs/outputs, TV cameras, joysticks, speech synthesizers, AC power controls, music synthesizers, plotters, printers, and frequency counters. One might think they have nothing in common, but they do — cost. They all are fairly expensive. On the other hand, how would you like to build a light pen for approximately thirty dollars? No, this is not a construction article, and don't believe I am the ultimate expert on this subject, I'm not. I have not built this circuit because I don't have a computer. However, feel free to use, discard, or elaborate on any of the ideas here.

This light pen operates on the principle that when the electron beam passes over the phosphorous in a TV tube, the phosphorous quickly lights up. (See Figure 1.) Although most phototransistors couldn't follow the light input exactly, a good one should give an approximation, as in Figure 1-Point A. The signal then goes through C1 to screen out the effects of ambient light. The comparator IC 1 then changes this analog pulse into a digital one. IC A-B then shapes the digital pulse. At the same time, the video circuitry is reading memory to decide which character to output. ICs 4-7 store the address of the memory being accessed and therefore the address of the character to which it is pointing. The computer can read the latches via two input ports.

A critical part is the phototransistor. To be reliable, it must have a rise time of at most one microsecond, and preferably less. R1 has been calculated assuming an average (between maximum and minimum) phototransistor resistance of 50K. If yours varies drastically from this, you should alter R1, R2 and C1. SW1 is the on-off switch. I suggest you put it on the pen itself in a convenient position and it could be a very nice feature. To adjust R3 correctly, you take an oscilloscope and measure the peak voltage at Point B. The armature of R3 should be a bit less than that. The input lines connect directly to the video circuitry, to the character counter not the curser. One clue: the counter is usually connected to a high speed clock.

A light pen is very versatile. Can you imagine what kind of text editor you could have with it. Point at a word, press a button and the word disappears, or it moves, or it underscores a word. A light pen would make computer art a snap. You could draw a picture and have the computer distort it, perhaps. But, most importantly, a light pen would add a new dimension to computer games.



| | |
|---|---|
| Light Input | |
| Point A | |
| Point B | |
| Point C | |
| Point D | |
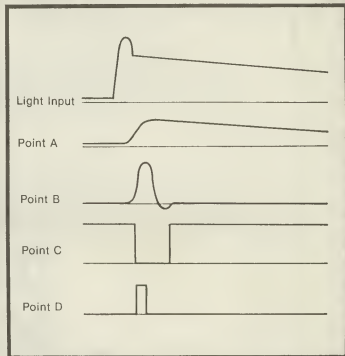
### Parts List for Figure 2 Schematic

C1,C2 — 100 pF. Cap.
IC1 — Voltage Comparator
IC2 — 7402 Quad NOR Gate
IC3 — 7404 HEX Inverter
IC4-7 — 7475 Quad Latches
IC8-11 — 74125 Quad Tristate Buffer
IC12 — 7430 8-Input NAND Gate
PT1 — Phototransistor
R1 — 50K Resistor
R2 — 500 K Resistor
R3 — Pot (most any value)
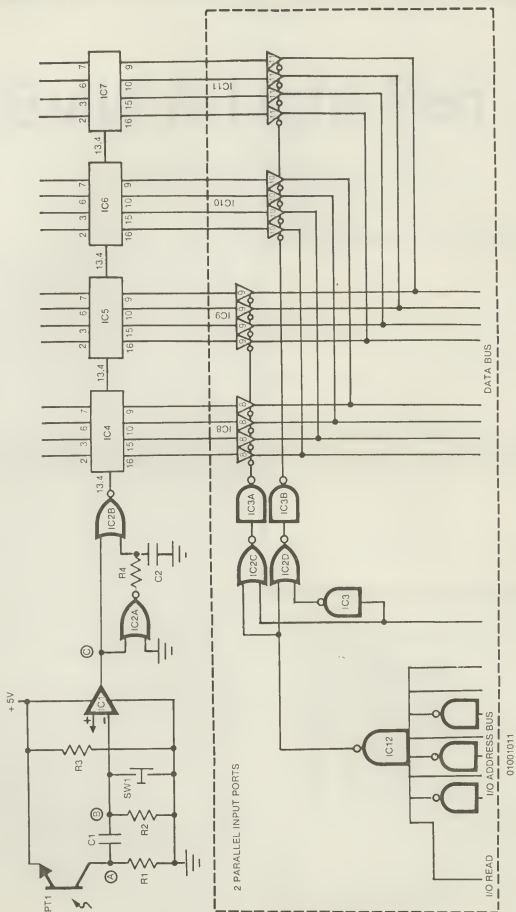R4 — 500 Ohm Resistor
SW1 — NC Miniature Pushbutton Switch

Figure 2. This is the schematic for the proposed light pen. Note that the lower half is just two parallel input ports.